Demand for industrial wood pellets in the US
“A rational and pragmatic off-ramp to a decarbonized future”

Demand for Heating Pellets in Canada
“A rational response to high heating energy costs”

November 4, 2015

William Strauss
FutureMetrics
FutureMetrics

Intelligent Analysis and Thought Leadership for the Wood Pellet Sector.

Selection of Current and Recent Clients of our Team
Senior Leadership

William Strauss
- 40 years of making thermal power from MSW and wood.
- Recipient of the 2012 International Excellence in Bioenergy Award

John Swaan
- The “grandfather of wood pellets”.
- Recipient of the 2014 International Founders Award for pioneering in the wood pellet sector

Kurt Malzer
- 25 years of adding value to wood fiber.
- Grew Fulghum Fibres from small Georgia chipper to global leader in contract chipping.

FutureMetrics – Intelligent Analysis and Thought Leadership for the Pellet Sector
The Industrial Pellet Markets?

Potentially about 26 million tonnes per year increase

North America and China?

FLAT
Heating Pellets Markets

About 8 million tonnes per year increase
But first, some material from Seth Walker,
Bioenergy Economist, RISI
North American Pellet Supply

Seth Walker, Bioenergy Economist
November 2015
North American Pellet Mill Map
US industrial Pellet Market Developments

- Drax – 2x facilities in LA completed

- Enviva – development at Port of Wilmington, announced JV with Hancock, acquisition of Green Circle

- German Pellets – Louisiana facility to be doubled to 1 million mt

- New entrants into the market:
  - Portucel – Greenwood County, SC
  - PHI Group/AG Materials – Live Oak, FL
    - Adjacent to Klaussner Sawmill

2014 US Pellet Exports by Company
Million MT

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US Pellet Exports

- UK by far the biggest destination
- 95% European industrial markets, besides UK:
  - Belgium
  - Netherlands
  - Denmark
- Some volume into Italian heating market – dried up in 2015
  - Exchange rates
United Kingdom
  • End of 2015 - Drax essentially at full consumption
    • 2x units converted, 1x unit >85% co-firing (1st conversion routine maintenance)
    • 1x Drax unit + RWE Lynnemouth – awaiting EC state-aid clearance for CfD

Belgium
  • German Pellets acquisition of E.ON Langerlo

Netherlands
  • New subsidy scheme (SDE+) was halted pending sustainability criteria
  • Criteria out – however no co-firing projects were awarded subsidies due to budget cap
  • Maximum co-firing demand 3.5-4.0 million mt

Denmark
  • Dong announced plans to convert Avedore Unit 1 – sooner than RISI expected
US “Domestic” Pellet Production

Million Metric Tons

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“Domestic” pellet market capacity and demand

• Excess capacity development 2006-2009 after strong demand growth
• 2009-present – growth slowed, allowed demand to “catch up”, cold winters in 2014-2015 helped
• Some trade to Italy developed 2013-2014
• Limited export potential
  • Exchange rates
  • Economies of scale
  • Good margins at home
FutureMetrics index of the business climate for domestic heating pellet producers

Market Conditions for NE Premium Pellet Producers

source: FutureMetrics
Canadian Pellet Production

British Columbia

- After several slow years, capacity development picks up
- Forecast: production to increase from 1.8 million mt in 2014 to 2.4 million mt in 2019

Eastern Canada

- Rentech continues commissioning operations in Ontario and at Port of Quebec
- Forecast: production to increase from 500,000 mt in 2014 to 1.5 million mt in 2019
Canadian Pellet Exports

- UK still the biggest destination – 60%
- Cross boarder trade with the United States is significant
- Italy – 2nd biggest offshore destination
  - Residential heating
- Asian industrial markets
  - Korea took a step back in 2015
  - Japan – “slow and steady”
Other Canadian Export Markets

• Italy
  ~ 2,000,000 stoves in use – growing by ~200,000 units per year

• Korea
  • Boom then bust market for Canada
  • Explanation follows

• Japan
  • Moderate volumes for co-firing
  • RISI expects an increase in the short term for biomass CHP plants coming online with FIT subsidy
  • Possible upside with expansion of FIT scheme (co-firing or conversions)
Korean Pellet Imports
Thousand Metric Tons – Quarterly
Korean Pellet Demand by Company and Total Imports
Thousand Metric Tons - Monthly
Korean Pellet Inventory and Price
Outlook for Global Pellet Markets

• European industrial markets
  • UK, Belgium, Danish markets – fairly stable (despite what you may hear)
  • Dutch market uncertainty – biggest “swing” in industrial market

• European heating markets
  • Oil prices and warm winters – big headwinds
  • US producers also have to deal with XR issues

• North America
  • Slow and steady growth, good margins, limited upside

• Asia
  • Much less bullish on Korea than 1 year ago
    • Most volume from Vietnam
  • Japan could become an important destination for BC producers
Thank you for your attention!
For more information:

North American Bioenergy 5-Year Forecast

RISI Special Study: Global Pellet Demand Outlook
www.risi.com/globalpelletdemand
What is the next market for the industrial wood pellet sector?

Is this likely? Perhaps not.

But most would find it prudent to have an option to hedge the risk...

source: RISI Global Pellet Outlook (2015) to 2024, flat projection after 2024 except UK, analysis by FutureMetrics
Can the **Clean Power Plan** (CPP) enable the development of an industrial pellet market in the **US** for co-firing wood pellets with coal in US coal power plants?
The Clean Power Plan can enable a Co-firing Strategy

The CPP will require the U.S. power sector as a whole to reduce greenhouse gas (GHG) emissions by 32 percent from 2005 levels by 2030.

Each state has a distinct 2030 target based on its particular energy mix.

States will need to submit draft State Implementation Plans (SIPs) to EPA to demonstrate how they will comply. States can request extensions but must submit a SIP no later than September 6, 2018.
This is about wood pellets blended with coal in pulverized coal power plants.

Why not wood chips?
• They cannot be used in pulverized coal plants unless dried and milled first.
  • The plant is captive to the surrounding wood basket.
Of all power plants with generation capacities of 250 megawatts or more, pulverized coal fired power plants represent 265,400 megawatts of the total of 528,100 megawatts for the entire US – 50%!
FutureMetrics

- Globally Respected Consultants in the Wood Pellet Sector
Why Coal Producing Companies should support Co-firing under the CPP

Natural gas is stealing coal’s market share at a rapid pace!
The Potential For US Co-firing
(images from FutureMetrics dashboard)

Potential for substantial demand!
FutureMetrics - Globally Respected Consultants in the Wood Pellet Sector
Gradual increase in the blend ratio for the off-ramp to the decarbonized future.

Also allows the supply chain to develop.
A complex optimization* was run to determine the best locations for new pellet production sites for a US industrial pellet market.

*FutureMetrics uses Palisade Corporation’s Decision Tools Suite and in particular for this analysis, RiskOptimizer. RiskOptimizer uses genetic algorithms and complex optimization math to converge on optimal solutions to problems with many combinations of inputs.
## Jobs and New Tax Revenues!

Estimated jobs for a 240,000 ton per year plant*

<table>
<thead>
<tr>
<th>ImpactType</th>
<th>Employment</th>
<th>Labor Income</th>
<th>Total Value Added</th>
<th>Output</th>
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</thead>
<tbody>
<tr>
<td>Direct Effect</td>
<td>176.7</td>
<td>$14,258,929</td>
<td>$22,425,525</td>
<td>$57,182,687</td>
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<tr>
<td>Indirect Effect</td>
<td>150.5</td>
<td>$6,986,115</td>
<td>$9,425,723</td>
<td>$20,618,042</td>
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<tr>
<td>Induced Effect</td>
<td>133.7</td>
<td>$5,385,608</td>
<td>$9,654,023</td>
<td>$16,178,738</td>
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<tr>
<td>Total Effect</td>
<td>461.0</td>
<td>$26,630,651</td>
<td>$41,505,270</td>
<td>$93,979,467</td>
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</table>

### State and Local Tax Impact (using Maine input/output data and multipliers)

<table>
<thead>
<tr>
<th>Description</th>
<th>Employee Compensation</th>
<th>Tax on Production and Imports</th>
<th>Households</th>
<th>Corporations</th>
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</thead>
<tbody>
<tr>
<td>Dividends</td>
<td></td>
<td></td>
<td>$3,870</td>
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<tr>
<td>Social Ins Tax- Employee Contribution</td>
<td>$7,482</td>
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<td>Social Ins Tax- Employer Contribution</td>
<td>$13,264</td>
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<tr>
<td>Tax on Production and Imports: Sales Tax</td>
<td>$1,482,691</td>
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<tr>
<td>Tax on Production and Imports: Property Tax</td>
<td>$1,806,849</td>
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<tr>
<td>Tax on Production and Imports: Motor Vehicle Lic</td>
<td>$32,562</td>
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<td>Tax on Production and Imports: Severance Tax</td>
<td>$148,956</td>
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<td>Tax on Production and Imports: Other Taxes</td>
<td>$97,471</td>
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<tr>
<td>Corporate Profits Tax</td>
<td></td>
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<td>$99,355</td>
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<tr>
<td>Personal Tax: Income Tax</td>
<td>$604,514</td>
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<tr>
<td>Personal Tax: NonTaxes (Fines- Fees)</td>
<td>$121,451</td>
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<tr>
<td>Personal Tax: Motor Vehicle License</td>
<td>$25,793</td>
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<tr>
<td>Personal Tax: Property Taxes</td>
<td>$15,648</td>
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<tr>
<td>Personal Tax: Other Tax (Fish/Hunt)</td>
<td>$29,563</td>
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<tr>
<td><strong>Total State and Local Tax</strong></td>
<td><strong>$20,746</strong></td>
<td><strong>$3,568,528</strong></td>
<td><strong>$796,968</strong></td>
<td><strong>$103,223</strong></td>
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<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>$4,489,465</strong></td>
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</table>

### Federal Tax Impact

<table>
<thead>
<tr>
<th>Description</th>
<th>Employee Compensation</th>
<th>Proprietor Income</th>
<th>Tax on Production and Imports</th>
<th>Households</th>
<th>Corporations</th>
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<tbody>
<tr>
<td>Social Ins Tax- Employee Contribution</td>
<td>$830,415</td>
<td>$379,493</td>
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<tr>
<td>Social Ins Tax- Employer Contribution</td>
<td>$1,079,003</td>
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<tr>
<td>Tax on Production and Imports: Excise Taxes</td>
<td>$264,607</td>
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<tr>
<td>Tax on Production and Imports: Custom Duty</td>
<td>$111,653</td>
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<tr>
<td>Tax on Production and Imports: Fed NonTaxes</td>
<td>$0</td>
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<tr>
<td>Corporate Profits Tax</td>
<td></td>
<td></td>
<td></td>
<td>$695,879</td>
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</tr>
<tr>
<td>Personal Tax: Income Tax</td>
<td>$1,342,784</td>
<td>$379,493</td>
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</tr>
<tr>
<td><strong>Total Federal Tax</strong></td>
<td><strong>$1,909,418</strong></td>
<td><strong>$379,493</strong></td>
<td><strong>$376,261</strong></td>
<td><strong>$1,342,784</strong></td>
<td><strong>$695,879</strong></td>
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<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>$4,703,835</strong></td>
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</table>

*FutureMetrics uses IMPLAN to calculate the economic impacts of manufacturing wood pellets.*
Canadian Heating Pellet Market Demand?
(from the latest FutureMetrics White Paper)

About 10% of US at around 350,000 tonnes per year.

Why?

<table>
<thead>
<tr>
<th>Heating Fuel for Homes in Canada</th>
<th>Electricity</th>
<th>Natural gas</th>
<th>Oil</th>
<th>Wood</th>
<th>Propane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>39%</td>
<td>50%</td>
<td>7%</td>
<td>6%</td>
<td>1%</td>
</tr>
<tr>
<td>Newfoundland and Labrador</td>
<td>71%</td>
<td>0%</td>
<td>21%</td>
<td>22%</td>
<td>0%</td>
</tr>
<tr>
<td>Prince Edward Island</td>
<td>0%</td>
<td>0%</td>
<td>76%</td>
<td>32%</td>
<td>0%</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>29%</td>
<td>0%</td>
<td>54%</td>
<td>26%</td>
<td>0%</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>66%</td>
<td>0%</td>
<td>13%</td>
<td>23%</td>
<td>0%</td>
</tr>
<tr>
<td>Quebec</td>
<td>85%</td>
<td>3%</td>
<td>8%</td>
<td>7%</td>
<td>0%</td>
</tr>
<tr>
<td>Ontario</td>
<td>14%</td>
<td>76%</td>
<td>5%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Manitoba</td>
<td>37%</td>
<td>61%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>11%</td>
<td>87%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
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<tr>
<td>Alberta</td>
<td>9%</td>
<td>91%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>British Columbia</td>
<td>39%</td>
<td>55%</td>
<td>3%</td>
<td>5%</td>
<td>0%</td>
</tr>
</tbody>
</table>

source: Statistics Canada, Oct. 2015, analysis by FutureMetrics
After the commissioning of the Muskrat Falls hydro project power costs are expected to be at least $0.18/ kWh in NL

### Power Use per Person

<table>
<thead>
<tr>
<th>MWh’s per Person/Year</th>
<th>Red - Above Avg</th>
<th>Green - Below Avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>4.03</td>
<td></td>
</tr>
<tr>
<td>Newfoundland and Labrador</td>
<td>6.59</td>
<td></td>
</tr>
<tr>
<td>Prince Edward Island</td>
<td>3.16</td>
<td></td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>4.37</td>
<td></td>
</tr>
<tr>
<td>New Brunswick</td>
<td>6.72</td>
<td></td>
</tr>
<tr>
<td>Quebec</td>
<td>6.39</td>
<td></td>
</tr>
<tr>
<td>Ontario</td>
<td>3.12</td>
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<tr>
<td>Manitoba</td>
<td>4.34</td>
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</tr>
<tr>
<td>Saskatchewan</td>
<td>2.87</td>
<td></td>
</tr>
<tr>
<td>Alberta</td>
<td>2.23</td>
<td></td>
</tr>
<tr>
<td>British Columbia</td>
<td>3.70</td>
<td></td>
</tr>
</tbody>
</table>

source: Statistics Canada, Oct. 2015, analysis by FutureMetrics

### Cost per Person/Year for Heat

<table>
<thead>
<tr>
<th>Cost per Person/Year for Heat</th>
<th>Electricity per MWh</th>
<th>Cost per person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newfoundland and Labrador</td>
<td>$124.00</td>
<td>$817</td>
</tr>
<tr>
<td>Prince Edward Island</td>
<td>$169.00</td>
<td>$535</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>$157.00</td>
<td>$685</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>$113.00</td>
<td>$759</td>
</tr>
<tr>
<td>Quebec</td>
<td>$68.00</td>
<td>$434</td>
</tr>
<tr>
<td>Ontario</td>
<td>$141.00</td>
<td>$440</td>
</tr>
<tr>
<td>Manitoba</td>
<td>$179.00</td>
<td>$777</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>$132.00</td>
<td>$378</td>
</tr>
<tr>
<td>Alberta</td>
<td>$122.00</td>
<td>$272</td>
</tr>
<tr>
<td>British Columbia</td>
<td>$89.00</td>
<td>$330</td>
</tr>
</tbody>
</table>

source: Statistics Canada, Oct. 2015, analysis by FutureMetrics

### Cost of Heating per kWh

- **#2 heating oil**: $0.803 per liter
- **Propane (Residential)**: $0.701 per liter
- **Pellets - Bag Prices**: $300.00 per tonne
- **Electricity**: $0.180 per kWh

source: Newfoundland and Labrador Board of Commissioners of Public Utilities, Petroleum Pricing Order Effective
Thank You!

FutureMetrics

www.FutureMetrics.com

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